

Appl. No. 10/620,324
Response Dated 3/17/2005

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

These amendments introduce no new matter and support for the amendments is replete throughout the application as originally filed. These amendments are made without prejudice and are not to be construed as abandonment of the previously claimed subject matter, or agreement with any objection or rejection of record.

Listing of Claims:

Claim 1 (Currently Amended): A grasping mechanism, comprising movably coupled arms that are structured to grasp an object, wherein the arms are movably coupled to each other such that the arms can move towards or away from each other along a first axis, wherein at least one of the arms comprises a stop, wherein one or more of the arms comprises a pivot member having a support surface to support the object and a height adjusting surface that pushes the object into contact with the support surface when the arms grasp the object, and further wherein the arms are attached to a body that comprises a resilient coupling which allows the arms to move in a direction substantially perpendicular to the first axis when the stop pushes the object against a push surface.

Claim 2 (Original): The grasping mechanism of claim 1, wherein the grasping mechanism is structured to grasp the object between the arms.

Claim 3 (Original): The grasping mechanism of claim 1, wherein the resilient coupling allows the arms to move along a y-axis.

Claim 4 (Original): The grasping mechanism of claim 1, wherein the arms comprise a polished or coated surface that reduces friction between the object and the arms, relative to an unpolished or non-coated surface, when the object is grasped by the arms.

Claim 5 (Original): The grasping mechanism of claim 1, wherein the arms comprise one or more rollers that reduce friction between the object and the grasping mechanism, relative to arms that lack the rollers, when the object is grasped by the arms.

Claim 6 (Original): The grasping mechanism of claim 1, further comprising the object.

Claim 7 (Original): The grasping mechanism of claim 6, wherein the object is selected from the group consisting of: a plate, a sample plate, a micro-well plate, a reaction block, a reaction block carrier, a sample holder, a petri dish, a test tube, a vial, a crucible, a reaction vessel, a reaction flask, a semi conductor wafer, a CD, and a tray.

Claim 8 (Canceled)

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Claim 9 (Currently Amended): The grasping mechanism of claim 8~~1~~, wherein the stop is structured to determine a y-axis position of the object.

Claim 10 (Original): The grasping mechanism of claim 9, wherein the y-axis position of the object is determined with an accuracy to within about 0.1 millimeters.

Claim 11 (Original): The grasping mechanism of claim 1, wherein an interface between the arms and the body comprises at least one spring, which spring resiliently couples the arms to the body.

Claim 12 (Original): The grasping mechanism of claim 11, wherein the interface comprises a sliding interface.

Claim 13 (Canceled)

Claim 14 (Original): The grasping mechanism of claim 13, wherein each support surface is disposed between two height adjusting surfaces, which height adjusting surfaces are angled to push the object into contact with the support surface when the object is grasped.

Claim 15 (Original): The grasping mechanism of claim 13, wherein the support surface and the height adjusting surface form a channel to grasp the object.

Claim 16 (Original): The grasping mechanism of claim 13, wherein the support surface comprises a substantially horizontal surface to support the object and the height adjusting surface comprises an angled surface that intersects with the substantially horizontal surface, which angled surface pushes the object into contact with the substantially horizontal surface when the arms grasp the object.

Claim 17 (Canceled)

Claim 18 (Currently Amended): The grasping mechanism of claim 1~~4~~7, wherein the pivot member is resiliently coupled to the arm.

Claim 19 (Original): The grasping mechanism of claim 18, wherein the arm further comprises a stop that is resiliently coupled to the arm.

Claim 20 (Currently Amended): The grasping mechanism of claim 13, wherein the support surface determines an x-axis position of the object and the height adjusting surface determines a z-axis position of the object when the arms grasp the object.

Claim 21 (Original): The grasping mechanism of claim 20, wherein the x-axis and z-axis positions of the object are determined with an accuracy to within about 0.1 millimeters.

Claim 22 (Original): The grasping mechanism of claim 1, wherein the grasping mechanism is movably connected to a boom, which boom is movably connected to a base.

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Claim 23 (Original): The grasping mechanism of claim 22, wherein the boom rotates about 360 degrees.

Claim 24 (Original): The grasping mechanism of claim 22, wherein the boom and the base comprise a robot.

Claim 25 (Original): The grasping mechanism of claim 22, wherein the boom moves vertically and horizontally.

Claim 26 (Original): The grasping mechanism of claim 25, wherein the boom extends and retracts.

Claim 27 (Original): The grasping mechanism of claim 22, further comprising at least one controller operably connected to the grasping mechanism, which controller controls movement of the grasping mechanism.

Claim 28 (Original): The grasping mechanism of claim 27, wherein the controller further controls movement of the boom.

Claim 29 (Currently Amended): The grasping mechanism of claim 28, wherein the controller comprises at least one logic device having one or more logic instructions that direct the boom to:

contact the object with the grasping mechanism such that the object is pushed against ~~at~~ the push surface by the stops, whereby the resilient coupling allows the arms to reversibly recede from an initial position; and

grasp at least a section of the object with the arms, after which the arms advance at least substantially back to the initial position.

Claim 30 (Original): The grasping mechanism of claim 29, wherein the arms each comprise a channel and wherein the logic instructions further direct the grasping mechanism to partially close prior to the contacting step to position the section of the object at least partially within the channel.

Claim 31 (Original): The grasping mechanism of claim 29, wherein the logic instructions further direct the boom to remove the object from a first position and place the object at a second position.

Claim 32 (Original): The grasping mechanism of claim 27, further comprising at least one sensor that communicates with the controller to determine a location of the grasping mechanism relative to the object.

Claim 33 (Original): The grasping mechanism of claim 32, wherein the sensor is selected from the group consisting of: an optical sensor, a photoelectric sensor, an infrared sensor, a position sensor, a laser distance sensor, and a magnetic sensor.

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Claim 34 (Original): The grasping mechanism of claim 22, further comprising a deflectable member that deflectively couples the grasping mechanism to the boom, which deflectable member deflects when the grasping mechanism contacts the object or another item with a force greater than a preset force.

Claim 35 (Original): The grasping mechanism of claim 34, wherein the deflectable member comprises a breakaway.

Claim 36 (Currently Amended): A gripper apparatus, comprising:
at least one robot comprising a boom;
at least one grasping mechanism comprising movably coupled arms that are structured to grasp an object, wherein at least one of the arms comprises a stop, wherein one or more of the arms comprise a pivot member having a support surface to support the object and a height adjusting surface that pushes the object into contact with the support surface when the arms grasp the object, and wherein the grasping mechanism is resiliently coupled to the boom by a resilient coupling which allows the arms to reversibly recede from an initial position when the stop pushes the object against a push surface;
and,

at least one controller operably connected to at least the grasping mechanism, which controller controls movement of the grasping mechanism.

Claim 37 (Original): The gripper apparatus of claim 36, wherein the grasping mechanism comprises two arms.

Claim 38 (Original): The gripper apparatus of claim 36, wherein the grasping mechanism is structured to grasp the object between the arms.

Claim 39 (Original): The gripper apparatus of claim 36, wherein the controller is operably connected to the robot and further controls movement of the robot.

Claim 40 (Original): The gripper apparatus of claim 36, wherein the boom moves vertically and horizontally.

Claim 41 (Original): The gripper apparatus of claim 40, wherein the boom extends and retracts.

Claim 42 (Currently Amended): The gripper apparatus of claim 36, wherein ~~one or more~~both of the arms each comprise at least one support surface and at least one height adjusting surface.

Claim 43 (Original): The gripper apparatus of claim 42, wherein each support surface is disposed between two height adjusting surfaces; which height adjusting surfaces are angled to push the object into contact with the support surface when the object is grasped.

Claim 44 (Original): The gripper apparatus of claim 42, wherein the support surface comprises a substantially horizontal surface to support the object and the height adjusting

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surface comprises an angled surface that intersects with the substantially horizontal surface, which angled surface pushes the object into contact with the substantially horizontal surface when the arms grasp the object.

Claim 45 (Canceled)

Claim 46 (Currently Amended): The gripper apparatus of claim ~~45~~36, wherein the pivot member is resiliently coupled to the arms.

Claim 47 (Original): The gripper apparatus of claim 36, wherein the resilient coupling between the grasping mechanism and the boom comprises at least one spring, which spring resiliently couples the grasping mechanism to the boom.

Claim 48 (Original): The gripper apparatus of claim 47, wherein the resilient coupling comprises a sliding interface.

Claim 49 (Currently Amended): The gripper apparatus of claim 36, wherein ~~at least one of the arms further comprises a stop and~~ the controller comprises at least one logic device having one or more logic instructions that direct the gripper apparatus to:

contact the object with the grasping mechanism such that the object is pushed against ~~at the~~ push surface by the stop, whereby the resilient coupling allows the arms to reversibly recede from ~~an the~~ initial position; and

grasp at least a section of the object with the arms, after which the arms advance at least substantially back to the initial position.

Claim 50 (Original): The gripper apparatus of claim 49, wherein the logic instructions further direct the gripper apparatus to remove the object from a first position and place the object at a second position.

Claim 51 (Original): The gripper apparatus of claim 36, further comprising a deflectable member that deflectively couples the grasping mechanism to the boom, which deflectable member deflects when the grasping mechanism contacts an item with a force greater than a preset force.

Claim 52 (Original): The gripper apparatus of claim 51, wherein the deflectable member comprises a breakaway.

Claim 53 (Original): A gripper apparatus, comprising:
a grasping mechanism comprising movably coupled arms that are structured to grasp an object, wherein at least one arm comprises a stop and a pivot member having:
a) a support surface to support the object; and
b) a height adjusting surface that pushes the object into contact with the support surface;
such that when the arms grasp the object the support surface and the height adjusting surface determine at least a z-axis position of the object;

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a deflectable member that deflectively couples the grasping mechanism to a boom;

a controller coupled to the grasping mechanism, which controller controls movement of the grasping mechanism; and,

at least one push surface against which the gripper apparatus pushes the object into contact with the stop to determine a y-axis position of the object.

Claim 54 (Currently Amended): A method of grasping an object, the method comprising:

providing a gripper apparatus that comprises a controller coupled grasping mechanism having movably coupled arms that are structured to grasp an object, wherein at least one arm comprises a stop, wherein one or more of the arms comprise a pivot member having a support surface to support the object and a height adjusting surface that pushes the object into contact with the support surface when the arms grasp the object, and wherein at least two grasping mechanism components are resiliently coupled to each other by a resilient coupling;

contacting the object such that the object is pushed against a push surface by the stop, whereby the resilient coupling allows the arms to reversibly recede from an initial position; and,

grasping at least a section of the object with the arms, after which the arms advance at least substantially back to the initial position.

Claim 55 (Original): The method of claim 54, further comprising removing the object from a first position and placing the object at a second position.